

## Computer Networks- Unit 01

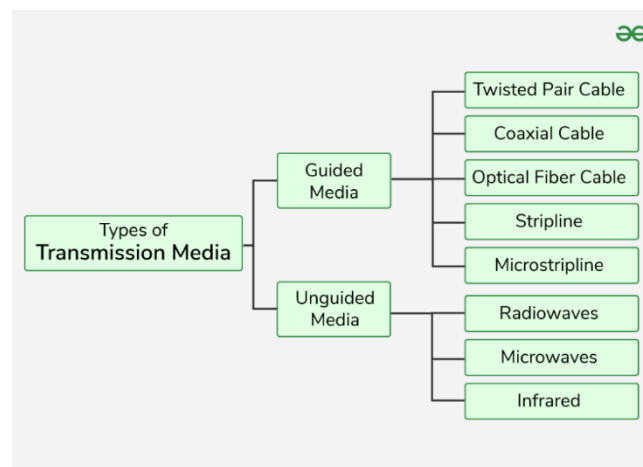
### Difference between OSI model and TCP/IP

Aspect	OSI Model	TCP/IP Model
Full Form	Open Systems Interconnection Model	Transmission Control Protocol/Internet Protocol
Layers	7 layers (Physical, Data Link, Network, Transport, Session, Presentation, Application)	4 layers (Network Access, Internet, Transport, Application)
Development	Developed by ISO as a theoretical framework for standardizing network protocols	Developed by the U.S. Department of Defense for the internet
Approach	A theoretical model, used as a reference for teaching and design	A practical model based on standard protocols for network communication
Protocol Dependency	Protocol-independent, does not specify specific protocols	Protocol-specific, defines standard protocols like TCP and IP
Layer Separation	Strict layer separation, each layer has distinct functions	Layers are more fluid, with some overlap in functionality
Reliability	Ensures reliable communication with clear error handling mechanisms at multiple layers	Reliability is primarily handled by the Transport layer (TCP)
Examples of Use	Used as a conceptual framework in networking education and theoretical designs	Widely used for real-world internet communication and networking implementation

## 2. Unguided Media

1. Definition: Unguided media refers to communication channels that transmit data without the use of physical cables or wires, relying on electromagnetic waves instead.
2. Types: Common types include radio waves, microwaves, and infrared waves, each with varying frequencies and ranges.
3. Transmission Range: The range of transmission can vary significantly, from short-range (infrared) to long-range (satellite communication).
4. Flexibility: Provides more flexibility in deployment, especially for mobile and remote communication where physical cabling is impractical.
5. Interference: Susceptible to environmental factors like weather, obstacles, and electromagnetic interference, which can affect signal quality.
6. Applications: Widely used in technologies such as Wi-Fi, Bluetooth, satellite communications, and cellular networks.

**Transmission Media**-A transmission medium is a physical path between the transmitter and the receiver i.e. it is the channel through which data is sent from one device to another. Transmission Media is broadly classified into the following types:



## 1. Guided Media

Guided Media is also referred to as Wired or Bounded transmission media. Signals being transmitted are directed and confined in a narrow pathway by using physical links.

Features: High Speed, Secure, Used for comparatively shorter distances

### 1. Twisted Pair Cable

- **Unshielded Twisted Pair (UTP):** UTP consists of two insulated copper wires twisted around one another. This type of cable has the ability to block interference and does not depend on a physical shield for this purpose. It is used for telephonic applications.



**Unshielded Twisted Pair**

Unshielded Twisted Pair

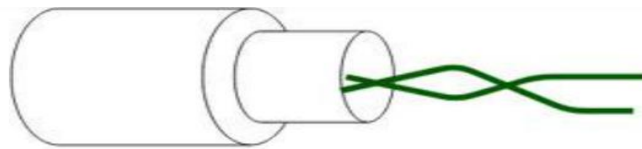
#### Advantages of Unshielded Twisted Pair

- Least expensive
- Easy to install
- High-speed capacity

#### Disadvantages of Unshielded Twisted Pair

- Lower capacity and performance in comparison to STP
- Short distance transmission due to attenuation

- **Shielded Twisted Pair (STP):** cable consists of a special jacket (a copper braid covering or a foil shield) to block external interference. It is used in fast-data-rate Ethernet and in voice and data channels of telephone lines.



### Shielded Twisted Pair

*Shielded Twisted Pair*

**Shielded Twisted Pair (STP):** Shielded Twisted Pair (STP) cable consists of a special jacket (a copper braid covering or a foil shield) to block external interference. It is used in fast-data-rate Ethernet and in voice and data channels of telephone lines.

#### Advantages of Shielded Twisted Pair

- Better performance at a higher data rate in comparison to UTP
- Eliminates crosstalk
- Comparatively faster

#### Disadvantages of Shielded Twisted Pair

- Comparatively difficult to install and manufacture
- More expensive
- Bulky

## 2. Coaxial Cable-

Coaxial cable has an outer plastic covering containing an insulation layer made of PVC or Teflon and 2 parallel conductors each having a separate insulated protection cover. The coaxial cable transmits information in two modes: Baseband mode (dedicated cable bandwidth) and Broadband mode (cable bandwidth is split into separate ranges). Cable TVs and analog television networks widely use Coaxial cables.

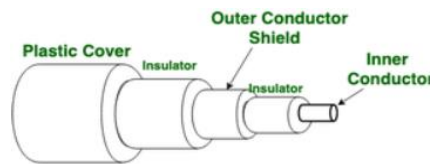


Figure of Coaxial Cable

### Advantages of Coaxial Cable

- Coaxial cables has high bandwidth.
- It is easy to install.
- Coaxial cables are more reliable and durable.
- Less affected by noise or cross-talk or electromagnetic inference.
- Coaxial cables support multiple channels

### Disadvantages of Coaxial Cable

- Coaxial cables are expensive.
- The coaxial cable must be grounded in order to prevent any crosstalk.
- As a Coaxial cable has multiple layers it is very bulky.
- There is a chance of breaking the coaxial cable and attaching a “t-joint” by hackers, this compromises the security of the data.

## 3. Optical Fiber Cable

Optical Fibre Cable uses the concept of refraction of light through a core made up of glass or plastic. The core is surrounded by a less dense glass or plastic covering called the coating. It is used for the transmission of large volumes of data. The cable can be unidirectional or bidirectional. The WDM (Wavelength Division Multiplexer) supports two modes, namely unidirectional and bidirectional mode.

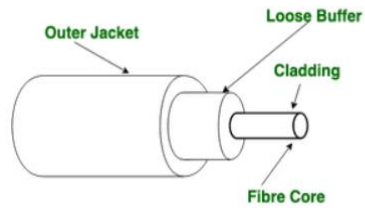


Figure of Optical Fibre Cable

### Advantages of Optical Fibre Cable

- Increased capacity and bandwidth
- Lightweight
- Less signal attenuation
- Immunity to electromagnetic interference
- Resistance to corrosive materials

### Disadvantages of Optical Fibre Cable

- Difficult to install and maintain
- High cost

### Applications of Optical Fibre Cable

- **Medical Purpose:** Used in several types of medical instruments.
- **Defence Purpose:** Used in transmission of data in aerospace.
- **For Communication:** This is largely used in formation of internet cables.
- **Industrial Purpose:** Used for lighting purposes and safety measures in designing the interior and exterior of automobiles.

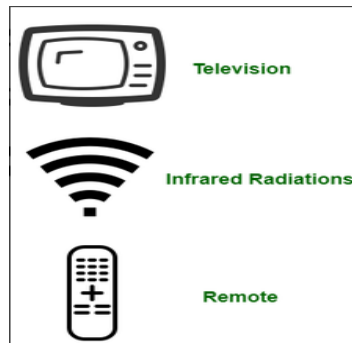
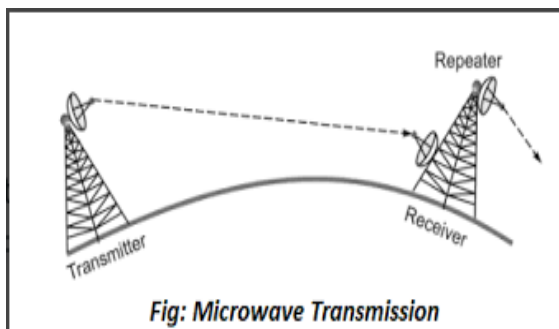
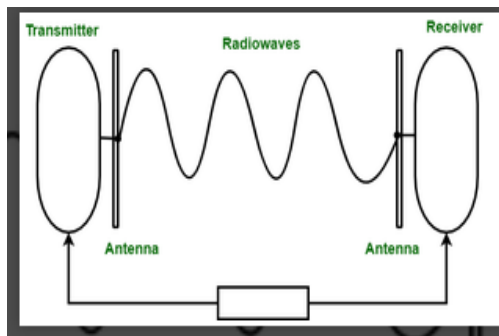
## 2. Unguided Media

It is also referred to as Wireless or Unbounded transmission media\_ No physical medium is required for the transmission of electromagnetic signals.

### Features of Unguided Media

- The signal is broadcasted through air
- Less Secure
- Used for larger distances

There are 3 types of Signals transmitted through unguided media:



## Difference Between Radio Waves, Micro Waves, and Infrared Waves

Basis	Radiowave	Microwave	Infrared wave
<b>Direction</b>	These are omni-directional in nature.	These are unidirectional in nature.	These are unidirectional in nature.
<b>Penetration</b>	At low frequency, they can penetrate through solid objects and walls but high frequency they bounce off the obstacle.	At low frequency, they can penetrate through solid objects and walls. at high frequency, they cannot penetrate.	They cannot penetrate through any solid object and walls.
<b>Frequency range</b>	Frequency range: 3 KHz to 1GHz.	Frequency range: 1 GHz to 300 GHz.	Frequency range: 300 GHz to 400 GHz.
<b>Security</b>	These offers poor security.	These offers medium security.	These offers high security.
<b>Attenuation</b>	Attenuation is high.	Attenuation is variable.	Attenuation is low.
<b>Government License</b>	Some frequencies in the radio-waves require government license to use these.	Some frequencies in the microwaves require government license to use these.	There is no need of government license to use these waves.
<b>Usage Cost</b>	Setup and usage Cost is moderate.	Setup and usage Cost is high.	Usage Cost is very less.
<b>Communication</b>	These are used in long distance communication.	These are used in long distance communication.	These are not used in long distance communication.

## Difference Between Twisted pair cable, Co-axial cable, and Optical fiber

Characteristics	Twisted pair cable	Co-axial cable	Optical fiber cable
Signal transmission	Takes place in the electrical form over the metallic conducting wires.	Takes place in the electrical form over the inner conductor of the cable.	Takes place in an optical form over glass fiber.
Consists of	Pair of insulated copper wires	Requires 4 components from inner to outer- <ul style="list-style-type: none"><li>• Solid conductor wire</li><li>• Layer of insulation</li><li>• Grounding conductor</li><li>• Layer of exterior insulation.</li></ul>	Bundling of very thin optical fibers made up of glass or plastic in a single cable.
Installation and Implementation	Simple and easy	Relatively difficult	Difficult
External magnetic field	Affected due to external magnetic field.	The external magnetic field is less affected.	The external magnetic field is not affected.
Cause of power	Power loss due to conduction and radiation.	Power loss due to conduction.	power loss due to absorption, scattering, and bending.
Diameter	Large diameter than Optical fiber cable.	Large diameter than Optical fiber cable.	Small diameter
Bandwidth	The twisted-pair cable has low bandwidth.	Co-axial cable has moderately high bandwidth.	Optical fiber cable has a very high bandwidth.

<b>Electromagnetic interference(EMI)</b>	EMI can take place.	EMI is reduced to shielding.	EMI is not present.
<b>Installation</b>	Easy installation.	Fairly easy installation.	Difficult to install.
<b>Attenuation</b>	In twisted pair cable has very high attenuation.	In coaxial cable has low attenuation.	In optical fiber cable has very low attenuation.
<b>Data rate</b>	Twisted pair cable supports a low data rate.	Moderately high data rate.	Very high data rate.
<b>Noise immunity</b>	Twisted pair cable has low noise immunity.	Co-axial cable has higher noise immunity.	Optical fiber cable has the highest noise immunity.
<b>Cost</b>	The cost is very low.	Cost is moderate	Cost is expensive.
<b>Repeater Spacing</b>	Repeater spacing is 2-10 km.	Repeater spacing is 1-10 km.	Repeater spacing is 10-100 km.
<b>Security</b>	Security is not guaranteed of the transmitted signal.	Security is not guaranteed of the transmitted signal.	Security is guaranteed of the transmitted signal.
<b>Types</b>	<ul style="list-style-type: none"> <li>• Unshielded Twisted Pair (UTP)</li> <li>• Shielded Twisted Pair (STP)</li> </ul>	<ul style="list-style-type: none"> <li>• RG59</li> <li>• RG6</li> </ul>	<ul style="list-style-type: none"> <li>• Single mode fiber (SMF)</li> <li>• Multimode fiber (MMF)</li> </ul>
<b>Power loss</b>	Reasons-conduction and radiation	Reasons- absorption, scattering dispersion and bending	Reasons-conduction